



REPORT

ON THE

EFFECTS OF INDUSTRIAL WASTES

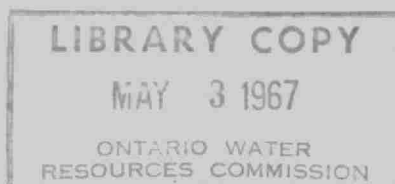
ON

SEWAGE TREATMENT PLANT OPERATIONS

AT

STRATFORD

DECEMBER, 1958 TO MAY, 1960



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R E P O R T

on the

E F F E C T S O F I N D U S T R I A L W A S T E S

on

S E W A G E T R E A T M E N T P L A N T O P E R A T I O N S

at

S T R A T F O R D

December, 1958 to May, 1960

by: R. H. Millest
J. B. Patterson } OWRC
R. C. Stewart }

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The effect of the disposal of industrial wastes to the sanitary sewers in Stratford has been under study by the Ontario Water Resources Commission for some time. A survey made in 1958 outlined the principal sources and characteristics of wastes throughout the municipality, and concluded, in part, with the following summary:

"The survey of the disposal of Industrial Wastes at Stratford has indicated that, with a few exceptions noted below, the acceptance of industrial wastes should present no treatment plant operating difficulties of any consequence. Much of the industry is "dry", including such processes as fabricating and manufacturing furniture and automobile upholstery, machine parts, electrical apparatus, etc. The total waste flow of some 500,000 gallons, plus flows still to be metered, can be quite readily handled in the treatment plant where the flow design is 4,000,000 gallons per day.

Considering the hydraulic loading, the decision to assess at least a part of the sewer-use charge on a water-use basis has made it worthwhile on the part of large consumers to measure the sewer flows and to segregate clean wastes for separate discharge to storm sewers. This has already indicated that discharges to the sanitary sewers will be kept to a minimum wherever feasible, thus minimizing the hydraulic loading on the plant.

The largest single water-user in Stratford is the C.N.R. with total daily consumption of both municipal water and untreated river water of approximately 450,000 to 500,000 gallons, (based

on annual consumption of 20,000,000 cu. ft. per year). Much of the water used in the locomotive shops is for boiler and tender testing, and is discharged without use in the shops and hence without the introduction of waste materials. Some oil and grease are lost as parts are steamed after washing in caustic cleaner, but normally the quantities are not excessive. It is probable that slugs of oil are released when the caustic tanks are cleaned out. Since the C.N.R. does not expect to operate the shops at Stratford for more than a few years, it is difficult to suggest any changes in present waste disposal unless the need should be pressing. This does not seem to be the case.

The heaviest industrial waste loading, strength-wise, is from the plant of the Whyte Packing Co., Ltd. A separate report has been prepared, in which it is shown that the sewered population equivalent, based on BOD, is approximately 24,000, and, based on suspended solids, approximately 10,000. Improved removal of suspended solids at the packinghouse would not only lower this latter figure, but would also reduce the BOD, and thereby lessen the loading on the secondary stage of sewage treatment. Improved solids recovery could include facilities for more complete recovery of greases as well. While the results of sampling did not show an excessive amount of greases in the waste, clogging of the Barminutor at the sewage treatment plant by animal fats, some of which would likely come from the Whyte plant, has already occurred.

The operation of the Swift Canadian chicken-killing plant has presented a unique problem, as feathers have been encountered in the treatment plant since it has been opened. Since feathers are not removed by sewage treatment, but eventually pass on to the receiving stream, it is necessary to eliminate them completely at the source. Screening of the total effluent at the Swift plant should be provided.

Several sources of toxic wastes arising from plating and metal-working processes were investigated, but it is expected that their effects on sewage treatment will be slight, if there is any effect at all, because of the dilution afforded before reaching the treatment plant. Determination of cyanide and chromium concentrations in raw sewage samples at the sewage treatment plant would serve as an indicator of the need for pre-treatment.

Analysis of samples of waste from Avalon Fabrics, Ltd. indicates that, except for colour removal, no difficulty should be experienced in treating the waste at the sewage treatment plant. Colour may be a problem at times, depending on the intensity of dyes being discharged, but, for the most part, dye-wastes should receive adequate dilution before reaching the treatment plant."

Since completion of the treatment plant, operating difficulties have been experienced that are believed to be due to excessive loading by packinghouse and chicken-killing wastes. Because of the excessive strength

of these wastes, almost all of the capacity of the plant is required to reduce the BOD and remove settleable solids as intended by the initial plant design. If the plant is to serve its expected future needs and also provide for future expansion in the municipality, the need for reduction in waste strength is indicated, even though the treatment plant still has ample capacity for the volume of waste to be treated.

CHARACTERISTICS OF SEWAGE

Although sanitary sewage is a very complex mixture of all the domestic and industrial wastes from the community, a treatment plant is designed principally on the basis of the removal of a few characteristics, or components, that usually remain fairly consistent from day to day. For the purpose of this discussion, only suspended solids, BOD, toxicity, and oils and/or greases will be considered.

Suspended Solids:- The removal of settleable solids is effected in the primary section of the treatment plant, with the clarified sewage then proceeding on to the secondary (biological) stage for removal of soluble components that still remain. The settled primary sludge is pumped to a digester where it is partially stabilized by septic or anaerobic decomposition (in the absence of oxygen). The digested sludge is drawn off periodically for land disposal.

Normal sanitary sewage carries about 300 parts per million of suspended solids, or about 300 pounds per hundred thousand gallons of sewage. (This would amount to about 6 tons of suspended solids in 4,000,000 gallons of sewage.) Samples of the raw sewage entering the Stratford plant show the concentration of suspended solids to be quite normal for the most part. With

digester operations stabilized, the plant should be able to handle the suspended solids without trouble.

BOD:- The biochemical oxygen demand, or BOD, is a measurement of the amount of oxygen required for the stabilization of the decomposable organic material in sewage. The untreated sewage entering a treatment plant usually contains about 300 parts per million BOD, and the treated effluent about 15 parts per million or less. Since plant design is based on this strength, any increase beyond 300 parts per million in the raw sewage adds to the treatment plant loading just as much as would an increase in hydraulic loading. Part of the BOD would be removed in the primary section of the plant, depending on the amount of organic solids that would be so-removed, and the remainder in the secondary section of the plant where the clarified sewage is subjected to biological treatment. Examination of the attached results indicates BOD removal in the primary section of the plant of up to about 75 per cent for some samples. However, since the BOD of the raw sewage was generally quite high, the BOD of the clarified sewage entering the secondary part of the plant was also high.

Toxicity:- Since parts of the sewage treatment process (sludge digestion and secondary treatment) depend on biological activity, the control of toxic or poisonous substances to tolerable levels is necessary. Although many toxic substances may be discharged from modern industry, wastes from metal plating are perhaps the most significant. Cyanide, chromium (hexavalent), copper, zinc, and other metals are to be controlled. Only chromium was found to be present in excessive concentrations in the sewage entering the Stratford

plant, and that was a year or so ago. It would seem to be under control now, since none has been detected since June, 1959.

Grease:- Significant quantities of fats and greases in sewage entering the municipal sewage treatment plant tend to accumulate and adversely affect the primary treatment process. It is also believed that the demand for oxygen in the secondary process is increased when soluble oils are present. Thus, it is considered desirable to limit the concentration of oils, fats or greases of animal or vegetable origin to 100 parts per million or less for discharge to sanitary sewerage systems.

DISCUSSION

Although there are industries operating in Stratford that have process wastes to be discharged to the sanitary sewers, only four are felt to be significant to sewage plant operation: Whyte Packing Co., Ltd., Swift Canadian Ltd., Avalon Fabrics, Ltd., and Sealed Power Corp., Ltd. Studies have shown that, of these four, Whyte's and Swift's are constant sources of strong wastes, and therefore are of major importance, while Avalon Fabrics discharges highly-coloured waste from time to time that, except for the strong colour, can be readily treated in the municipal plant. The discharge of chromium from the plant of Sealed Power Corp. has been a problem in the past, but there has been no excessive concentration of this toxic waste component found in the sewage since June, 1959.

Whyte Packing Co., Ltd.:- A recent review of the disposal of wastes from this plant indicates a reduction in waste strength since 1958, although part of this may be due to seasonal fluctuation (see graph). In-plant controls,

improved housekeeping practices, and modification and improvement of equipment to recover wastes have been discussed in a separate OWRC Report (dated March 15, 1960). The report concludes that the overall strength of the packinghouse wastes, based on BOD, is still some 3 to 4 times greater than that of normal sanitary sewage, however, and recommends further control of suspended solids, brine, hog-scalding water, and other wastes. The objective should be to provide a packinghouse effluent as close as possible in strength to the strength of sanitary sewage in which the maximum concentrations of waste components might be as shown in Appendix A attached.

Swift Canadian, Ltd.:- The problem of eliminating feathers and minimizing the discharge of blood and fats in the waste waters being discharged from the Swift chicken-killing plant has been the subject of several surveys, with only partial solution to date. The most recent report reiterates the recommendations that were made two years ago when it was proposed that the company:

1. Install mechanically-cleaned screens (preferably of the vibrating type) to eliminate all feathers and retain other suspended solids from the wastes.
2. Improve the present system of collecting blood as a means of minimizing the BOD of the waste.
3. Install grease traps on the plant sewers.

Limiting the concentrations of BOD, suspended solids, and fats or greases, to conform with the quality of normal sanitary sewage, and complete

elimination of feathers should be undertaken without delay. (See Appendix A).

GENERAL

The control of industrial waste discharges to municipal sanitary sewers has been the subject of a great deal of study for many years. While controls are only needed as a means of providing a sewage of such quality that the treatment plant can produce a suitable effluent and, at the same time, afford adequate protection to the sewage works, it is necessary to set out a framework of control that may, at times, appear to be much more rigid than necessary. Experience has shown that the requirements suggested in Appendix A ensure adequate control.

CONCLUSIONS & RECOMMENDATIONS

The disposal of excessively strong industrial wastes to the Stratford sewage treatment plant has been a principal factor in the occurrence of operating difficulties that have been encountered from time to time. Packinghouse and chicken-killing wastes, in particular, effect the quality of the sewage entering the treatment plant to such an extent that the degree of treatment required to produce a satisfactory effluent is greater than for normal sanitary sewage. As a result, the sewage plant has been operated at, or near, capacity to handle wastes for which it has ample hydraulic capacity. Two courses of action are available:

1. To enlarge the municipal sewage treatment plant to provide the necessary capacity for BOD and solids removal.
2. To limit the strength of industrial wastes to conform with the strength of normal sanitary sewage as suggested in the attached Appendix A.

Name of Industry	Type of Process	Water Consumption (gpd)		Remarks
		Private	Municipal	
Avalon Fabrics, Limited	Production of dyed rayon and viscoe upholstery fabrics	210,000 (capacity)	19,600	Waste consists mainly of batches of spent scouring and dyeing solutions. Except for colour, the waste should not adversely affect sewage plant operations. Blending of wastes throughout day to minimize colour might be desirable at times.
Blackstone Industrial Products, Limited	Fabrication of car heater cores	-	14,300	Some caustic and acid cleaners are used, but should not affect sewage treatment.
C.N.R. Shops	Maintenance and repair of steam locomotives	12,500,000 gal. per month - mostly discontinued	30,400 for shops, depot, etc.	Shops to be closed because of change-over to Diesels. Occasional losses of oil which were previously reported are no longer encountered.
G.L. Griffith and Son, Limited	Manufacture of rubber products for auto and other industries	18,000 (in ten hour period)	53,800	Most of the water used is for cooling and is discharged to adjacent creek. - all sanitary and some process wastes to sanitary sewer.
Fram Canada, Limited	Manufacture of oil, air, fuel filters, etc.	-	3,500	No process wastes.
Fischer Bearings Manufacturing, Ltd.	Manufacture of ball races - assembly of bearing units	-	6,500	No process wastes.
Kroehler Manufacturing Co., Ltd.	Upholstered furniture	-	10,000	No process wastes.
Made-Rite Products, Limited	Potato chips, popcorn, peanuts	-	8,650	Although the wastes are strong the volume is small so that there should be little effect on the sewage treatment plant.
Preston-Noelting Ltd. Faultless Caster, Ltd.	Office furniture and casters		10,000	A small cadmium plating operation produces a small waste flow - it should not be significant at the treatment plant.
Samsonite Limited	Fabricate and assemble luggage - assemble (only) metal kitchen shelf-tables	-	unknown	No process wastes.

Name of Industry	Type of Process	Water Consumption (gpd)		Remarks
		Private	Municipal	
Sealed Power Corp. Ltd.	Piston rings	-	37,300	Wastes consist of cleaning, chromeplating, "parkerizing" and cutting oil waste. Chromium may be excessive at times.
Stratford Chrome Plating	Job platers	-	14,300	Plant closed in 1960.
Stratford Machine and Tool Limited	Conveyors	-	unknown	No process wastes.
Stratford Packers Ltd.	Slaughterhouse, packinghouse	unknown	-	All waste goes to the company's septic tank and tile bed.
Swift Canadian, Limited	Chicken killing	-	67,000	Full reports have been written recommending improved collection of blood, installation of grease traps, and <u>complete</u> removal of feathers by mechanically-cleaned screens
Canadian Westinghouse International Co., Ltd.	Assembly of fractional H.P. electric motors	-	18,700	No process wastes. Cooling water to storm sewer. (-plant has been closed but is to be re-opened)
Whyte Packing Co., Ltd.	Slaughterhouse - packinghouse	-	160,000 of which 85,000 is for slaughterhouse	A full report has been prepared outlining the sources and characteristics of the principal wastes. Waste control should be improved to reduce the BOD, suspended solids, and greases. About 1,500 gallons of brine are dumped each day also, adding a heavy shock load to the treatment plant.
Cleaver-Brooks of Canada Limited	Assembly of industrial boilers	-	unknown	No process wastes.
Cooper-Bessemer of Canada Limited	Assembly of compressors	-	1,000 (industrial)	The waste is cooling water discharged at 150°F. to the sanitary sewer.

RAW SEWAGE - SEWAGE TREATMENT PLANT

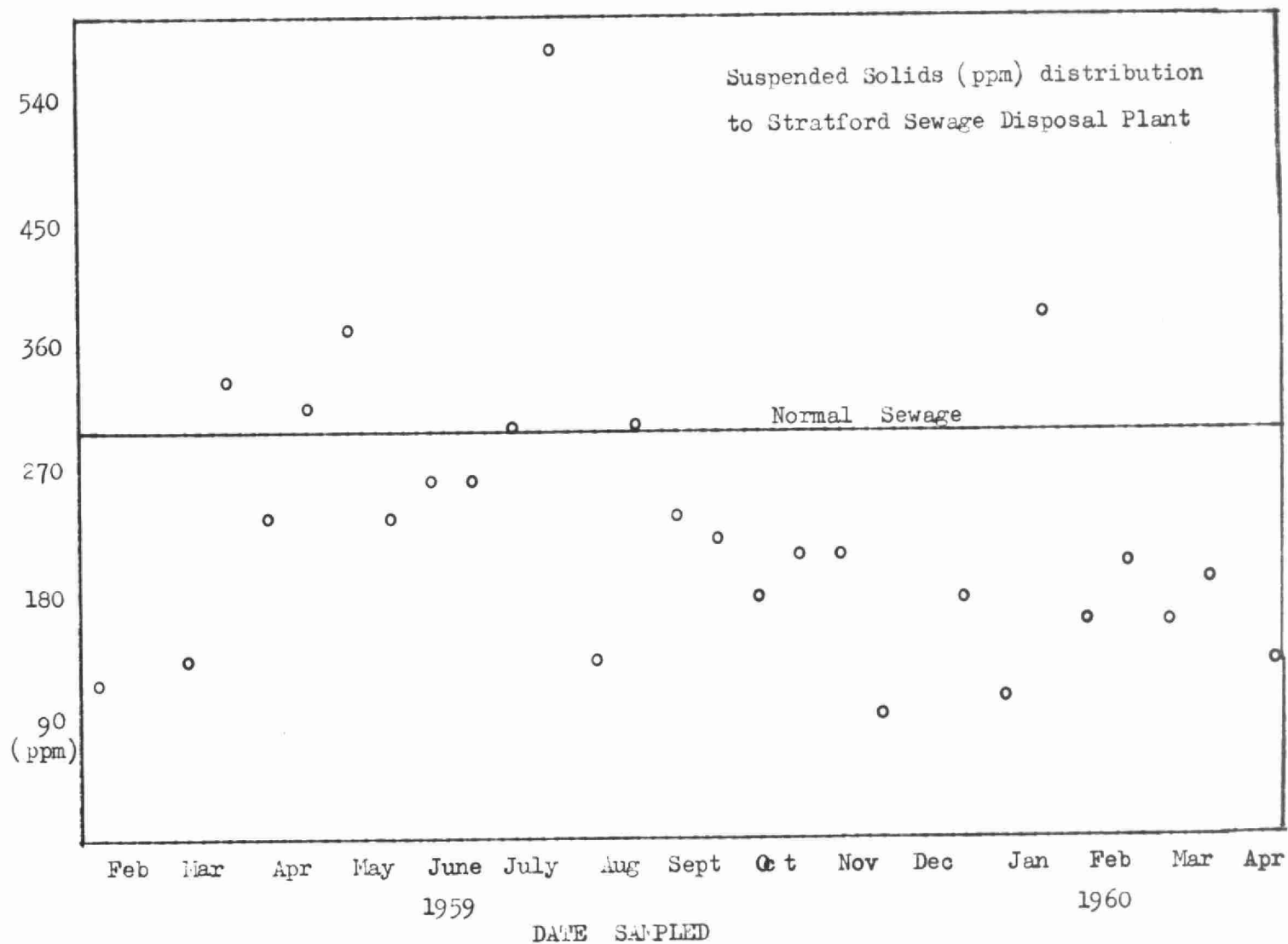
DATE	BOD (ppm)	S O L I D S (ppm)			C H R O M E (ppm)	
		TOTAL	SUSPENDED	DISSOLVED	TOTAL	HEXAVALENT
Dec. 30, 1958	380	1,428	186	1,242	-	-
Jan. 13, 1959	430	1,472	260	1,212	-	-
Feb. 10, 1959	215	1,056	116	940	0	0
Mar. 10, 1959	185	1,016	136	880	0.4	0
Mar. 30, 1959	320	1,092	336	756	0.02	0
Apr. 7, 1959	230	1,110	230	880	0.1	0.08
Apr. 21, 1959	386	1,236	316	920	0.1	0
May 12, 1959	530	1,232	374	958	0	0
May 27, 1959	300	1,240	234	1,006	1.15	0
June 16, 1959	412	1,470	264	1,206	0	0
June 23, 1959	554	1,538	264	1,274	0.2	0
July 15, 1959	454	1,722	304	1,418	0	0
Aug. 11, 1959	496	1,624	134	1,490	0	0
Aug. 25, 1959	570	1,584	298	1,286	0	0
Sept. 9, 1959	368	1,298	234	1,064	0	0
Sept. 22, 1959	436	1,304	216	1,088	0	0
Oct. 14, 1959	380	1,560	178	1,382	0	0
Oct. 27, 1959	220	1,146	204	942	-	-
Nov. 10, 1959	578	1,348	206	1,142	-	-
Nov. 24, 1959	285	1,050	86	964	0	0
Dec. 22, 1959	330	1,214	176	1,038	0	0
Jan. 12, 1960	230	1,026	104	922	0	0
Jan. 26, 1960	345	1,428	382	1,046	0	0
Feb. 10, 1960	195	1,190	156	1,034	0	0
Feb. 23, 1960	315	1,338	230	1,108	-	-
Mar. 8, 1960	255	1,370	162	1,208	0	0
Mar. 22, 1960	230	1,278	190	1,088	0	0
Apr. 12, 1960	175	908	154	754	0	0
Apr. 26, 1960	215	1,106	132	974	0	0
May 13, 1960	165	852	118	734	0	0

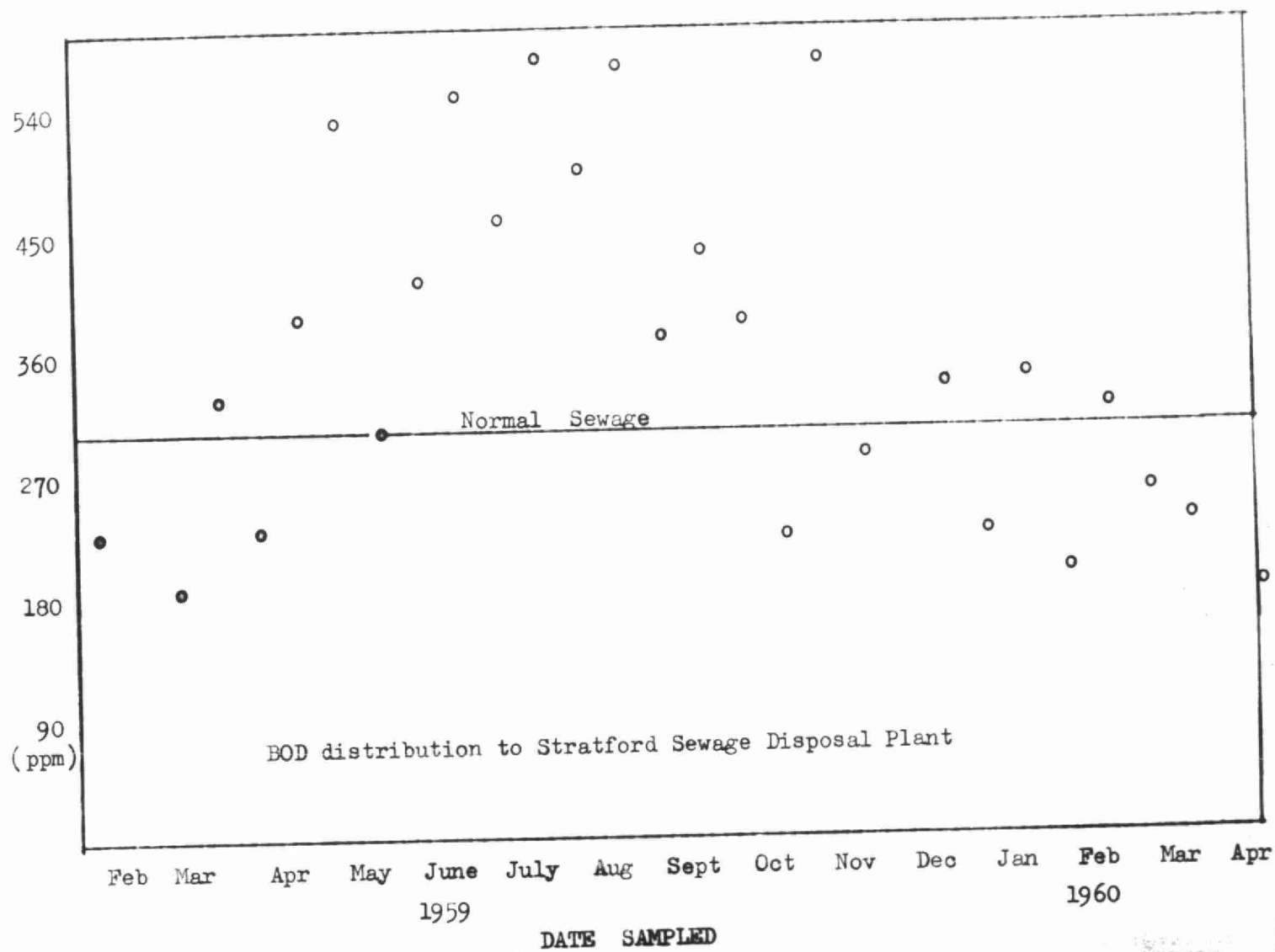
PRIMARY EFFLUENT- SEWAGE TREATMENT PLANT

DATE	BOD (ppm)	S O L I D S (ppm)			C H R O M E (ppm)	
		TOTAL	SUSPENDED	DISSOLVED	TOTAL	HEXAVALENT
Dec. 30, 1958	80	1,068	88	980	-	-
Jan. 13, 1959	180	1,014	32	982	-	-
Feb. 10, 1959	90	880	48	832	0	0
Mar. 10, 1959	54	720	40	680	0.35	0
Mar. 30, 1959	75	730	56	674	0.02	trace
Apr. 7, 1959	108	786	76	710	0.08	0.06
Apr. 21, 1959	92	940	100	840	0.16	0
May. 12, 1959	270	1,118	84	1,034	trace	0
May 27, 1959	134	900	60	840	0.5	0
June 16, 1959	387	1,136	76	1,060	0	0
June 23, 1959	141	1,086	60	1,026	0.2	0
July 15, 1959	-	-	-	-	-	-
July 28, 1959	182	1,234	122	1,112	0	0
Aug. 11, 1959	163	1,214	72	1,142	0.15	0
Aug. 25, 1959	179	1,396	92	1,304	0	0
Sept. 9, 1959	132	1,080	60	1,020	0	0
Sept. 22, 1959	155	1,030	50	980	0	0
Oct. 14, 1959	94	980	52	928	0	0
Oct. 27, 1959	196	962	114	848	-	-
Nov. 10, 1959	162	952	82	870	-	-
Nov. 24, 1959	175	868	56	812	0	0
Dec. 22, 1959	126	992	78	914	0	0
Jan. 12, 1960	92	892	42	850	0.06	0
Jan. 26, 1960	126	1,010	108	902	0	0
Feb. 10, 1960	116	1,092	92	1,000	0	0
Feb. 23, 1960	150	1,006	84	922	-	-
Mar. 8, 1960	150	1,138	90	1,048	0.14	0.14
Mar. 22, 1960	96	964	92	872	0	0
Apr. 12, 1960	48	736	50	686	0.02	0
Apr. 26, 1960	80	814	70	744	0	0
May 13, 1960	46	710	52	658	0	0

FINAL EFFLUENT - SEWAGE TREATMENT PLANT

DATE	BOD (ppm)	S O L I D S (ppm)			C H R O M E (ppm)	
		TOTAL	SUSPENDED	DISSOLVED	TOTAL	HEXAVALENT
Dec. 30, 1958	21	908	16	892	-	-
Jan. 13, 1959	2.4	876	8	868	-	-
Feb. 10, 1959	26	698	10	688	0	0
Mar. 10, 1959	34	686	16	670	0.30	0.20
Mar. 30, 1959	8.8	610	20	590	0.02	trace
Apr. 7, 1959	27	702	62	640	0.05	0.02
Apr. 21, 1959	11	828	14	814	0.06	0.01
May 12, 1959	8.8	646	18	628	0	0
May 27, 1959	13	780	14	766	0	0
June 16, 1959	35	900	30	870	0	0
June 23, 1959	84	998	30	968	0.02	0
July 15, 1959	-	-	-	-	-	-
July 28, 1959	13	1,078	18	1,060	0	0
Aug. 11, 1959	11	1,034	18	1,016	0	0
Aug. 25, 1959	10	1,254	38	1,216	0	0
Sept. 9, 1959	25	1,068	20	1,040	0	0
Sept. 22, 1959	26	486	50	436	0	0
Oct. 14, 1959	36	910	32	878	0	0
Oct. 27, 1959	14	580	36	544	-	-
Nov. 10, 1959	45	840	14	832	-	-
Nov. 24, 1959	7.2	760	14	746	0	0
Dec. 22, 1959	7.1	810	18	792	0	0
Jan. 12, 1960	10	932	14	918	trace	0
Jan. 26, 1960	11	892	20	872	0	0
Feb. 10, 1960	17	960	34	926	0	0
Feb. 23, 1960	8	912	32	880	-	-
Mar. 8, 1960	9	834	26	808	0.06	0.03
Mar. 22, 1960	10	848	28	820	0	0
Apr. 12, 1960	6.8	608	20	588	0.02	0.02
Apr. 26, 1960	23	746	12	734	0	0
May 13, 1960	5.2	620	28	592	0	0





APPENDIX 'A'

SUGGESTED INDUSTRIAL WASTE CONTROLS

Except as may be provided to meet specific local conditions, the following provisions may be made:

- no person shall discharge or cause to be discharged any of the described waters or wastes to any sanitary sewer.
- (a) Liquid or vapour having a temperature higher than 150°F.
- (b) Ashes, cinders, sand, earth, mud, straw, metal, glue glass, pigments, rags, textiles, tar, plastics, cellulose, wood and wood products, or other solid capable or causing obstruction to the flow in sewers or other interference with the proper operations of the sewage treatment plant(s).
- (c) Animal wastes such as hair, wool or fur, feathers, intestines or stomach casings, paunch manure or intestinal contents, hides or parts thereof, hooves, toenails, horns, bones and fleshings.
- (d) Water or wastes which may contain any volatile oils or more than 100 parts per million, by weight, of fat, oil or grease of animal or vegetable origin or grease of mineral origin.
- (e) Waters or wastes which have a five-day BOD greater than 300 parts per million by weight and a suspended solids concentration greater than 350 parts per million by weight.
- (f) Waters or wastes having a pH lower than 5.5 or higher than 9.5 or having any other corrosive property capable of causing damage or hazard to structures, equipment and personnel of the sewage works.
- (g) Gasoline, benzene, naptha, fuel oil, acetone, solvents or other inflammable or explosive liquid, solid or gas.

SUGGESTED INDUSTRIAL WASTE CONTROLS (cont'd.)

- (h) Waters or wastes containing a toxic or poisonous substance in sufficient quantity to injure or interfere with any sewage treatment process or constitute a hazard to humans or animals. Included in this category are waters or wastes containing metals or chemicals such as cyanide, hexavalent chromium, phenols, copper whose concentrations are more than:

Chromium as Cr (hexavalent)	3 ppm
Cyanide	2 ppm
Phenol	15 ppb
Copper	1 ppm

- (i) Noxious or malodorous gas or substance capable of creating a public nuisance including hydrogen sulphide, carbon disulphide.

Grease, oil and sand interceptors shall be provided when, in the opinion of the Town Engineer, or Inspector, they are necessary for the proper handling of liquid wastes containing grease in excessive amounts, or any flammable wastes, sand and other harmful ingredients. All interceptors shall be of a type and capacity approved by the Town Engineer or Inspector, and shall be located as to be readily and easily accessible for cleaning and inspection.

All measurements, tests and analyses of the characteristics of industrial wastes to which reference is made in this By-Law, shall be determined in accordance with the Standard Methods for the Examination of Water, Sewage and Industrial Wastes.

More detail of a complete industrial waste control by-law, may be found in "Municipal Sewer Ordinances - Manual of Practice No. 3" - Federation of Sewage Works Associations, Lancaster, Pa., U.S.A.

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